

DEPARTMENT OF THE AIR FORCE

SUPPORTING DATA FOR FISCAL YEAR 1988/89 BUDGET ESTIMATES

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DESCRIPTIVE SUMMARIES

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

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AMENDED FY1988/FY 1989 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603402F
 DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
 Budget Activity: 6 - Defense-Wide Mission Support

1. (U) RDT&E RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1987 Actual	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		49,093	53,887	72,796	Continuing	N/A
2617	Free-Flyer Spacecraft Missions	24,589	29,527	27,849	Continuing	N/A
2618	Quick Response Shuttle Missions	512	1,104	4,003	Continuing	N/A
2619	Teal Ruby Mission	11,794	11,987	25,276	36,172	278,963
2620	Shuttle Sortie Missions	12,198	11,269	15,668	Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Space Test Program (STP) advances DOD technology by providing spaceflight missions for experiments that demonstrate new space system technologies, concepts, and designs and for experiments that determine space environmental effects on DOD space systems. This tri-Service program provides the only substantial spaceflight capability to perform fly-before-buy demonstrations of advanced technology designs. These experiments are flown based on relevance to existing military requirements and the availability of cost effective means of spaceflight on expendable launch vehicles or Shuttle. The STP is the pathfinder for exploiting the Shuttle as a manned DOD space laboratory to expedite the infusion of new technology into space systems through the use of simpler, incrementally designed, man-aided experiments. The experience gained from this approach will be a key element in fully defining military man's role in space.

3. (U) COMPARISON WITH FY 1988/FY 1989 DESCRIPTIVE SUMMARY: (\$ in thousands)

RDT&E	49,219	90,197	130,664	Continuing	N/A
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EXPLANATION: FY 1988 funds were reduced based on Congressional action. FY 1989 and outyear budgets were level funded. These budget reductions will require the termination of the P86-2, Starscan contract; cancellation of the P87-B mission which would demonstrate an advanced technology clock for the Global Positioning System; and delay of future missions on Scout-class expendable launch vehicles and government/commercial space platforms.

4. (U) OTHER APPROPRIATIONS FUNDS: Not Applicable

Program Element: 0603402F
DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense-Wide Mission Support

5. RELATED ACTIVITIES: Expendable launch vehicles and their corresponding launch support are funded by STP and procured through Space Boosters, PE 0305119F. Space Shuttle launch support is provided by Space Shuttle Operations, PE 0305171F. Host satellites for STP payloads include the Defense Meteorological Satellite Program, PE 0305160F; National Aeronautics and Space Administration's (NASA) Long Duration Exposure Facility; Navy Transit; NASA's Tracking and Data Relay Satellite; National Oceanic and Atmospheric Administration's (NOAA) Television Infra-Red Observation Satellite and Geosynchronous Operational Environmental Satellite; and classified programs. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Defense Nuclear Agency; Air Force Academy; Naval Post Graduate School; Naval Air Systems Command; Space and Naval Warfare Systems Command; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency; NASA; Defense Research Sciences, PE 0601102F; Geophysics, PE 0602101F; Materials, PE 0602102F; Aerospace Propulsion PE 0602203F; Advanced Weapons, PE 0602601F; Space Communications, PE 0603432F and Memorandum of Agreements (MOAs) exist between the Air Force and NASA's Goddard Space Flight Center and Marshall Space Flight Center, NOAA, Defense Advanced Research Projects Agency, Defense Nuclear Agency, Naval Research Laboratory, the Army's Engineering Topographic Laboratory. MOAs exist with Great Britain, Canada and Australia for the Teal Ruby program.

6. (U) WORK PERFORMED BY: The Air Force Systems Command's Space Division, Los Angeles AFS, CA, is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the Space Test Program (STP). Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. Current payload integration and/or spacecraft contractors are Rockwell International, Seal Beach, CA (P888, Teal Ruby/P80-1 spacecraft); Lockheed Missiles and Space Company, Sunnyvale, CA (P675, Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) 1A/Experiment Support System (ESS) spacecraft); Ball Aerospace, Boulder CO (P86-1, Combined Release and Radiation Effects Satellite and P86-2, Starscan); through Naval Space and Warfare Command (P87-2, Stacksat - previously known as the Polar Orbiting Mission); NASA's Goddard Space Flight Center, Greenbelt, MD (Spartan experiment carrier) and through NOAA, General Electric, Astro-Space Division, Princeton, NJ (TIROS host vehicle for three prototype environmental sensors).

7. (U) PROJECT LESS THAN \$10 MILLION IN FY 1989:

(U) Project: 2618, Quick Response Shuttle Missions. This STP project supports the flight of Quick Response Shuttle Payloads and military man in space demonstrations. These experiments maximize near-term flight opportunities on both DOD and NASA Space Transportation System missions by making use of available space in Shuttle mid/aft-deck lockers. They are designed to evaluate man's ability to meet unique DOD research and development as well as operational requirements. A total of thirteen experiments were flown prior to the Challenger accident in January 1986. Forty-three experiments are manifested or awaiting flight. In FY 1988 and FY 1989, with the resumption of Shuttle flights, STP will provide experiment integration support and personnel training. This is a continuing program. STP program personnel are developing cost estimating capabilities as they gain experience in integration and operations activities associated with these type of payloads. Due to the unique nature of these experiments, the cost estimates range from category I (Comprehensive) to category III (Budgetary).

Program Element: 0603402F
DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense Wide Mission Support

8. (U) PROJECT OVER \$10 MILLION IN FY 1989:

(U) Project: 2617, Free-Flyer Spacecraft Missions

A. (U) Project Description: This STP project advances DOD space technology by providing for the spaceflight of DOD prioritized experiments on STP developed free-flyer spacecraft. These flights are used for the demonstration of new system technologies, concepts and designs and for determining space environmental effects on military space systems. Expendable launch vehicles and their corresponding launch support are procured through Space Boosters, PE 35119F with STP appropriated funds. Shuttle launch support tasks are provided by PE 0305171F, Space Shuttle Operations. This project supports spacecraft development for the joint DOD (Air Force)/National Aeronautics and Space Administration's (NASA) Combined Release and Radiation Effects Satellite (CRRES) mission, the joint Air Force/Defense Nuclear Agency's Polar Beacon Experiment and Auroral Research (Polar BEAR) satellite, the STP/Defense Advanced Research Projects Agency's (DARPA) Starscan mission, and the joint Air Force/Navy's Stacksat mission. In addition, this project supports the integration and spaceflight of secondary payloads on free-flyer host spacecraft. These secondary payloads include three Navy sponsored environmental prototype sensors to be flown on the National Oceanic and Atmospheric Administration's (NOAA) Television Infra-Red Observation Satellites (TIROS); the Advanced Clock and Ranging Experiment (ACRE) on a Global Positioning System (GPS) qualification satellite and a space charge control system to be flown on NOAA's Geostationary Operational Environmental Satellite (GOES).

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1987 Accomplishments: The Polar BEAR mission was launched on 13 November 1986 aboard a Scout expendable launch vehicle. STP supported Polar BEAR on-orbit operations and data collection. CRRES completed final acceptance testing and was placed in storage at the contractor's facility awaiting a launch. Due to reduced STP FY 1987 funding, the Starscan spacecraft development and integration contract, award was delayed until June FY 1987. In addition, the FY 1987 Titan II launch vehicle funding for Starscan was delayed until FY 1988. Integration of the three environmental monitoring experiments on TIROS began. Initial planning for the Stacksat mission was begun, although contract award was delayed until FY 1988. The Atlas launch vehicle funding for Stacksat was delayed until FY 1988. Planned feasibility studies for ACRE using the GPS qualification satellite began. A feasibility study was initiated with NOAA to fly an active space charge control system on their GOES.

(2) (U) FY 1988 Program: STP launched the DARPA-sponsored Gamma-ray Advanced Detector (GRAD) space experiment on 8 January 1988 using a high altitude balloon. The launch, from McMurdo Sound, Antarctica, allowed the GRAD detectors to be validated by sensing gamma-rays emitted from a super nova. Polar BEAR on-orbit operations and support will continue. CRRES will be removed from storage and undergo systems level tests to ensure its readiness for an Atlas-Centaur launch in FY 1990. Due to the significant reduction in the FY 1988 President's Budget request, the Starscan spacecraft development and integration contract will be terminated. Procurement of the Titan II for this mission will also be terminated. The integration of the three environmental monitoring experiments on TIROS will continue with a

Program Element: 0603402F
DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense-Wide Mission Support

planned completion in FY 1989. The integration and acceptance testing of Stacksat spacecraft and the three experiments will continue. The Atlas launch vehicle procurement will also continue. The feasibility study for ACRE and other STP prioritized experiments will be cancelled due to the FY 1988 budget reduction. The active space charge control system will begin initial integration on the National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellite (GOES). Planned studies identifying spacecraft designs compatible with existing expendable launch vehicles will not be accomplished.

(3) (U) FY 1989 Planned Program and Basis for FY 1989 RDT&E Request: Stacksat will conclude testing and be launched from Vandenberg AFB, CA, in March 1989 by an Atlas launch vehicle. The Combined Release and Radiation Effects Satellite (CRRES) will conclude reacceptance testing and be prepared for shipment to Kennedy Space Center, FL, in preparation for the FY 1990 Atlas-Centaur launch. The integration of the three environmental experiments on NOAA's Television Infra-Red Observation Satellites (TIROS) will be completed and will be placed into storage while TIROS awaits an operational requirement to launch. The active space charge control system will complete integration aboard the GOES and also await an operational requirement to launch. Planning for the next polar orbiting mission and launch vehicle will begin. The cost estimating techniques used for the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation models, contractor estimates and a large data base of experience from previous STP free-flyer spacecraft missions. Due to the differing levels of mission maturity, the cost estimates range from category I (Comprehensive) to category III (Budgetary).

(4) (U) Program to Completion: This is a continuing program. This on-going project will continue to provide free-flying spacecraft and integration for DOD prioritized space demonstration which are not authorized their own means to space. STP will use both Shuttle and expendable launch vehicle opportunities based on cost, schedule and overall mission requirements.

C. (U) Major Milestones:

<u>Milestones</u>	<u>Date</u>
(1) (U) Successful Scout launch of P87-1, Polar Beacon Experiment and Auroral Research satellite	13 November 1986
(2) (U) Balloon launch of P87-3, Gamma-Ray Advanced Detector	8 January 1988
(3) (U) Atlas launch of P87-2; Stacksat	FY 1989
(4) (U) Atlas-Centaur launch of P86-1, CRRES	*(FY 1989) FY 1990
(5) (U) Titan II launch of TIROS with three secondary experiments	To Be Determined
(6) (U) Launch of GEOS with the space charge control experiment	To Be Determined

*Date presented in FY 1988/FY 1989 Descriptive Summary

(U) Explanation of Milestone Changes

(4) (U) Launch schedule delayed due to Challenger accident and procurement of the Atlas-Centaur.

Program Element: 0603402F
DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense-Wide Mission Support

9. (U) PROJECT OVER \$10 MILLION IN FY 1988 AND/OR FY 1989:

(U) Project: 2619, Teal Ruby Mission

A. Project Description: This project supports the development of an STP spacecraft (P80-1) for the Defense Advanced Research Projects Agency (DARPA)/Air Force Teal Ruby Mission (P888). The Teal Ruby mission, known by its primary DARPA payload of the same name, also carries Army, Navy and National Aeronautics and Space Administration (NASA) secondary payloads. The DARPA experiment will demonstrate new infrared technologies and collect data needed for the design of future

During the eleven months of operation, the Teal Ruby sensor will execute over 100 missions involving more than 240 targets. The three secondary payloads operating for up to three years include - a NASA designed ion thruster experiment testing capabilities for long-term satellite station-keeping; a Navy autonomous spacecraft navigation experiment; and an Army ultraviolet spectrometer experiment studying the space ultraviolet spectrum.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1987 Accomplishments: The Teal Ruby spacecraft remained in storage at the contractor's facility due to the Shuttle standdown. The Shuttle delay required certain spacecraft components to be replaced and the uplink/downlink software to be modified to be compatible with the Air Force Satellite Control Facility's new Data System Modernization. The feasibility of on-orbit servicing of the five gases onboard the Teal Ruby spacecraft and cryostat was initiated. Spacecraft refueling could double the on-orbit lifetime of the cryostat. Mission planning for the East Coast Shuttle launch continued.

(2) (U) FY 1988 Program: Teal Ruby was manifested for a Shuttle flight in FY 1990. Teal Ruby will remain in storage except during periodic health checks. The mission planning and operations software modifications will continue. Life-limited components will be procured for replacement prior to flight. The on-orbit servicing study will be completed and if necessary, spacecraft modifications will be initiated.

(3) (U) FY 1989 Planned Program and Basis for FY 1989 RDT&E Request: The Teal Ruby spacecraft and sensor will be removed from storage, reintegrated, and retested in preparation for the FY 1990 Shuttle launch. Contractor personnel released during the storage period will be rehired and retrained. All personnel will complete system training and flight recertification. Mission planning and software modifications will be completed and used during the personnel retraining. The cost estimating techniques used by the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation models, contractor estimates and a large data base of experience from previous STP free-flyer spacecraft missions. Since the costs of the remaining Teal Ruby activities are already on contract, the cost estimating range is category I (Comprehensive).

(4) (U) Program to Completion: Teal Ruby is planned to be launched in FY 1990. Reacceptance testing and launch readiness will conclude in FY 1990. After launch, data will be collected from the Teal Ruby sensor for up to

Program Element: 0603402F
DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense-Wide Mission Support

one year (or two years if the spacecraft is refueled) and from the three secondary experiments for three years.

C. (U) Major Milestones:

Milestones

Date

(U) Teal Ruby launch on Shuttle

*(FY 1991)

FY 1990

*Data presented in the FY 1988/FY1989 Descriptive Summary

(U) Explanation of Milestone Changes

(U) Shuttle launch manifest changed to accommodate Teal Ruby.

10. (U) PROJECT OVER \$10 MILLION IN FY 1988/OR FY 1989:

(U) Project: 2620, Shuttle Sortie Missions

A. (U) Project Description: This STP project advances DOD space technology by providing for the spaceflight of experiments on Shuttle sortie missions (payloads/experiments remain in the Shuttle and are returned) for demonstrating new system technologies, concepts, and designs and for determining space environmental effects on military space systems. Through sortie missions using generic reusable, standard STP Shuttle experiment support equipment, STP accomplishes its pathfinder role of exploiting the Shuttle as a manned DOD space laboratory. The project supports the flight of secondary experiments in National Aeronautics and Space Administration's (NASA) Get-Away-Special (GAS) canisters and on other Shuttle bay support structures such as Sortie Pallet for Shuttle (SPAS), Spartan, Hitchhiker-G and Hitchhiker-M being flown in the Shuttle sortie mode. The project provides for the procurement of generic reusable experiment support equipment; integration of sortie mission payloads with the Shuttle experiment support equipment and the integration of the combination into the Shuttle; mission/payload specialist training on STP hardware; launch support; on-orbit support and Aerospace Corporation systems engineering support. Specifically, this project currently supports the Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) 1A/Experiment Support System (ESS) mission, Air Force Program 675 (P675). P675 proof-of-concept data will support decisions on future Air Force and Strategic Defense Initiative Organization programs. P675 is planned for an FY 1990 launch.

B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1987 Accomplishments: Due to the Shuttle standdown, the CIRRIS 1A/ESS and the secondary experiments remained in storage. Mission replanning continued. Only essential contractor personnel were maintained. Secondary experiments were returned to the sponsors for upgrading and/or testing. Construction of a second generation Spartan reusable experiment carrier and its Shuttle support structure was initiated with the NASA's Goddard Space Flight Center later than planned due to the reduced FY 1987 Congressional appropriation. STP procurement of the SPAS was delayed until FY 1988 due to reduced FY 1987 funding. Identification, planning and procurement of generic equipment such as a large GAS canister capable of deploying small spacecraft was also delayed until FY 1988 due to

Program Element: 0603402F
DOD Missin Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense-Wide Mission Support

limited funds. Technical management support for the entire Program Element was funded in this project.

(2) (U) FY 1988 Program: The Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) 1A/Experiment Support System (ESS) pallet was manifested for a Shuttle flight in FY 1990. The CIRRIS 1A/ESS contractor support team will be reconstituted. The CIRRIS 1A/ESS pallet will be removed from storage and readied for reintegration of the experiments. Mission replanning for an East Coast launch will continue. Integration of the STP experiments onto the Spartan experiment carrier will begin. Procurement of a Sortie Pallet for Shuttle (SPAS) will be delayed until FY 1989 due to the significant FY 1988 budget reduction. Aerospace Corporation technical support is funded in this project.

(3) (U) FY 1989 Planned Program and Basis for FY 1989 RDT&E Request: The CIRRIS 1A/ESS pallet will be retested and recertified for spaceflight. The experiments will be redelivered by the sponsors and reintegrated on the pallet. After the reconstituted contractor support team is retrained and recertified the entire pallet will reaccomplish acceptance level testing including thermal vacuum testing. The integration of the Spartan experiment carrier will conclude. Procurement of the SPAS will commence. SPAS will be available for launch in FY 1992. SPAS is designed to carry up to 2000 pounds of experiments and fly free of the Shuttle for up to 40 hours. Aerospace Corporation technical support and program office support for the entire Program Element are funded in this project. The techniques used by the STP include the use of existing Air Force Systems Command cost models, independent Aerospace Corporation model and contractor estimate. Since no significant pricing data base exist for Shuttle sortie type missions, personnel are developing cost estimating capabilities as they gain experience in Shuttle integration and operation activities. Therefore, the cost estimates range from category I (Comprehensive) to category III (Budgetary).

(4) (U) Program to Completion: This is a continuing program. CIRRIS 1A/ESS is manifested to be launched in FY 1990. This project will continue to provide spaceflights for DOD space experiments on Shuttle sortie opportunities based on integration cost, Shuttle manifest and mission requirements. Development and upgrade of generic experiment support equipment which increases flight opportunities and reduces flight costs will continue. Initial studies will be conducted on the equipment necessary to make use of the National Aeronautics and Space Administration's Orbital Maneuvering Vehicle and the Space Station for DOD experiments. Spartan and SPAS will provide spaceflight opportunities for DoD experiments in FY 1990 and FY 1991, respectively and one flight per year thereafter. STP will continue to evaluate the Industrial Space Facility and other commercial platforms for demonstration of DOD space experiments.

C. (U) Major Milestones:

<u>Milestones</u>	<u>Dates</u>
(1) (U) Shuttle sortie mission of CIRRIS 1A/ESS	FY 1990
(2) (U) Shuttle sortie mission of Far Ultraviolet Imaging Spectrometer and Star Tracker on Spartan	*(FY 1989) FY 1990
(3) (U) Shuttle sortie mission of the reflight of Spartan	*(FY 1990) FY 1991
(4) (U) Shuttle sortie mission of SPAS	*(FY 1990) FY 1992

*Date presented in FY 1988/FY 1989 Descriptive Summary

Program Element: 0603402F
DOD Mission Area: 410 - Space Launch and Orbital Support

Title: Space Test Program (STP)
Budget Activity: 6 - Defense-Wide Mission Support

(U) Explanation of Milestones Changes

- (2) and (3) (U) Shuttle schedule delayed due to the Challenger accident.
- (4) (U) Delay caused by reduced funding.

11. (U) COOPERATIVE AGREEMENTS: Agreements exist with Great Britain, Canada and Australia for the Teal Ruby mission. These participants have agreed to provide targets of opportunity as well as members of their Air Forces to plan these missions. In return, they will receive only the mission data related to their targets. This is the only cooperative agreement with foreign participants in which STP is involved.